

SECTION VII. QUALITY ASSURANCE - INSPECTION AND TEST PROCEDURES

7.1 Introduction

The inspection-and-test portion of this handbook contains an accumulation of inspections, tests, and other controls required to assure that the intent of the design is met in the manufacturing cycle, based on the review and analysis of the manufacturing plan, process standards, and engineering requirements. Section VII is intended as a guideline for setting up an adequate inspection system to achieve a high-quality FCC system and should be adapted to the particular quality-control system that may be already in effect.

An inspection plan should be generated, relating inspection points to the manufacturing flow of materials from receiving through in-process assembly, final test, and installation.

The inspection plan is divided into three major areas of concern:

- a. Inspection and Test Plan Outline (Paragraph 7.2).
- b. In-Process Quality Control Flow Charts (Paragraph 7.3).
- c. Narrative descriptions (Paragraphs 7.4 through 7.8) of inspection points and controls.

These major areas present a description of those defects that may be found during receiving, processing, or installation of flat cables. Methods of inspection are also suggested to identify the defect or characteristic to be inspected. Military specifications, federal test standards, photographs, and sketches are referenced throughout this section that provide detailed information on defect identification, test methods, and procedures.

7.2 Inspection and Test Plan Outline

The following inspection and test plan outline (Table 7-1) is divided into four columns.

- a. Inspection parameter or point - Identifies a control point or defect to be inspected and references applicable paragraphs of the ensuing text.
- b. Method of inspection - Presents a description of the method and tools for identification of a defect or references a federal test standard.
- c. Inspection interval - Suggests the interval of inspection, either 100-percent inspection or a sample. The specific size of the sample will not be within the scope of this report. Exact sample plans can be initiated after standards are set, through experience, that will provide a satisfactory quality level. All sample plans that are initiated should adhere to the requirements presented in MIL-STD-105.
- d. Acceptance criteria.

7.3 In-Process Quality Control Flow Charts

The in-process quality control flow charts (Figs. 7-7, 7-8, and 7-9) can be used in conjunction with the outline to identify critical inspection points. Each significant manufacturing operation is referenced by paragraph number to the manufacturing procedure in Section VI, and each significant inspection is also referenced: Figure 7-7 is for FCC receiving and cable end preparation for plug termination; Figure 7-8 is for FCC premolded plug assembly; and Figure 7-9 is for FCC molded-on plug assembly.

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY MANUFACTURING

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.4 Receiving Inspection (Visual Mechanical)			
7.4.1 Cable Inspection			
7.4.1.1 Identification	Visual	100%	MIL-C-55543
7.4.1.2 Certification of Conductor Material	Visual	100 % Paper Inspection	MIL-C-55543
7.4.1.3 Packaging and Packing Inspection	Visual	100%	MIL-C-12000 & MIL-C-55543
7.4.1.4 Cable Dimensions (Unshielded)			
7.4.1.4.1 Width	See Figures 7-1 & 7-2	100% ^a	MIL-C-55543
7.4.1.4.2 Conductor Spacing	See Figures 7-1 & 7-2	100% ^a	MIL-C-55543

a. 100-percent inspection until a confidence level has been reached.

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.4.1.5 Cable Inspection (Shielded)	X-Ray	Sample	MIL-C-55543
7.4.1.5.1 Cable Dimension Measurement with Time Domain Reflectometry			
7.4.1.6 Workmanship	Viewing Screen, See Figure 7-1	100% ^a	MIL-C-55543
7.4.1.6.1 Bubbles	See Figure 7-3	100% ^a	MIL-C-55543
7.4.1.6.2 Delamination	See Figure 7-4	100% ^a	MIL-C-55543
7.4.1.6.4 Broken Conductors		100%	MIL-C-55543
7.4.1.6.5 General Damage	See Figure 7-1	100%	MIL-C-55543

a. 100-percent inspection until a confidence level has been reached.

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.4.1.7 Stripability	Strip Sample & Evaluate	Sample, Each In- spection Lot	See Manufacturing Section on Stripping
7.4.1.8 Receiving Inspection (Electrical Test)			
7.4.1.8.1 Continuity		100 %	
7.4.1.8.2 Insulation Resistance	Fed. Test Std. 228	Sample	MIL-C-55543
7.4.1.8.3 Conductor Resistance	Fed. Test Std. 228	Sample	MIL-C-55543
7.4.1.8.4 Dielectric Strength	Fed. Test Std. 228	Sample	MIL-C-55543
7.4.2 Receiving Inspection Premolded Plugs			
7.4.2.1 Identification	Visual	100 %	MIL-C-55544
7.4.2.2 Certification of Plug Material	Visual	100 %	

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.4.2.3 Packaging and Packing Inspection	Visual	100%	MIL-C-55544
7.4.2.4 Dimensions	Section Plug, Inspection Tool	Sample	MIL-C-55544
7.4.2.5 Workmanship			
7.4.2.5.1 Flash	Visual	Sample	
7.4.2.5.2 General Damage	Visual	Sample	
7.4.2.5.3 Porosity	Fed. Test Std. 406	Sample	MIL-C-55544
7.4.2.5.4 Plug Material Testing			
7.4.2.5.5 Insulation Resistance	Fed. Test Std. 406, Method 4041	Lot Sample	MIL-C-55544
7.4.2.5.6 Dielectric Withstand Voltage	Fed. Test Std. 406, Method 4031	Lot Sample	MIL-C-55544
7.4.2.5.7 Brittleness	Fed. Test Std. 406, Method 2051	Lot Sample	MIL-C-55544

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.4.3 Receiving Inspection of Related Plug Materials			
7.4.3.1 Premolded Plug Wedge & Retainer			
7.4.3.1.1 Dimensions	Visual	Sample	MIL-C-55544
7.4.3.1.2 Material Testing	See Paragraph 7.4.2.5.4	Sample	See Paragraph 7.4.2.5.4
7.4.3.2 Gasket	See Paragraph 7.4.2.5.4	Sample	See Paragraph 7.4.2.5.4
7.4.3.2.1 Dimensions	Visual	Sample	MIL-C-55544
7.4.3.2.2 Hardness	Durometer	Sample	Shore A 78 \pm 3

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.4.3.2.3 AGE Control & Storage			MSFC-STD-105
7.4.4 Potting Compound & Adhesives Control			
7.4.4.1 Identification & Storage	Visual	100%	MIL-STD-129D
7.4.4.2 Storage Surveillance			
7.4.5 Receiving Inspection of Receptacles			
7.4.5.1 FCC-FCC Rectangular Receptacle			
7.4.5.1.1 Identification	Visual	100%	MIL-C-55544 & MIL-STD-1290
7.4.5.1.2 Packaging and Packing	Visual	100%	MIL-D-116 & MIL-C-55544
7.4.5.1.3 Dimensions	Visual	Sample	MIL-C-55544

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.4.5.1.4 General Damage	Visual	Sample	MIL-C-55544
7.4.5.1.5 Material Identification	MIL-C-55544	Sample	MIL-C-55544
7.4.5.1.6 Material Finish	MIL-C-55544	Sample	MIL-C-55544
7.4.5.1.7 Mating and Unmating Forces	MIL-C-55544	Sample	MIL-C-55544
7.4.5.1.8 Electrical			
7.4.5.1.8.1 Contact Resistance	Method 307 of MIL-STD-202	Sample	MIL-C-55544
7.4.5.1.8.2 Low Level Contact	MIL-C-55544	Sample	MIL-C-55544
7.4.5.2 FCC to RWC Rectangular Receptacle	See Paragraph 7.4.5.1 - 7.4.5.1.8.2	Sample	MIL-C-55544
7.4.5.3 FCC to FCC Cylindrical Receptacle	See Paragraph 7.4.5.1 - 7.4.5.1.8.2	Sample	MIL-C-55544

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.4.5.4 FCC to RWC Cylindrical Receptacle	See Paragraph 7.4.5.1 - 7.4.5.1.8.2	Sample	MIL-C-55544
7.4.6 Receiving Inspection of Clamps and Supports			
7.4.6.1 Identification	Visual	100 %	MIL-STD-129
7.4.6.2 Packaging and Packing	Visual	100 %	MIL-D-116
7.4.6.3 Dimensions	Visual	Sample	
7.4.6.4 Workmanship	Visual	Sample	
a. General damage	Visual	Sample	
b. Plating consistency	Visual	Sample	
c. Spring tension	Visual	Sample	
d. Cushion hardness	Calibrated scale	Sample	
7.5 In-Process Inspection & Test of Cable Preparation for Terminating	Durometer	Sample	

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.5.1 Cable Shearing Inspection			
7.5.2 Cable Stripping Inspection			
7.5.2.1 Chemical Stripping			
7.5.2.1.1 Conductor Damage	Visual, 5X Magnification	100% In Process	
7.5.2.1.2 Wicking	Visual, 5X Magnification	100% In Process	Nonallowable
7.5.2.1.3 Insulation Damage	Visual, 5X Magnification	100% In Process	Nonallowable
7.5.2.1.4 Insulation Removal	Visual, 10X Magnification	100% In Process	
7.5.2.1.5 Dimensions	Visual	100% In Process	
7.5.2.2.1 Conductor Damage	Visual, 5X Magnification	100% In Process	

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.5.2.2.2 Complete Insulation Removal	Visual, 5X Magnification	100% In Process	QQ-M-290
7.5.2.2.3 Conductor & Insula- tion Cleanliness	Visual, 5X Magnification	100% In Process	
7.5.2.3 Acceptable Stripped Cable	Visual 5X Magnification	100% In Process	
7.5.3 Conductor and Shield Plating			
7.5.3.1 Nickel Plating			
7.5.3.1.1 Conductor Inspection	5X, Magnification	100% In Process	No Oxidation Allowable
7.5.3.1.2 Appearance	5X, Magnification	Sample	0.000 050 in. Max.
7.5.3.1.3 Thickness	Microphoto- Cross-Section	Sample	
7.5.3.1.4 Adhesion	Test Sample	Sample	
			No Separation After Test

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.5.3.1.5 Corrosion Resistance	See Fed. Test Std. 151, Method 811.1	Sample	See Fed. Test Std. 151
7.5.3.1.6 Sampling and Testing (Plating)		Sample	
7.5.3.1.7 Sampling and Testing Solutions		Lot Sample	
7.5.3.2 Gold Plating			MIL-G-45204
7.5.3.2.1 Conductor and Shield Inspection	5X Magnification	100% In Process	
7.5.3.2.2 Appearance	5X Magnification	100% In Process	
7.5.3.2.3 Thickness	Microphoto	Sample	
7.5.3.2.4 Adhesion	Test Sample	Sample	No Separation After Test
7.5.3.2.5 Sample & Test Plating		Sample	

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.6 Inspection & Test of Cable Terminations	See Paragraph 7.4.4		See Paragraph 6.3.5.1.1.1 No Conductor Damage No Separation Of Plating
7.6.1 Inspection of Molded-On Plug Assemblies			
7.6.1.1 Receiving Inspection			
7.6.1.1.1 Molding Compound			
7.6.1.1.2 Parts Assembly			
7.6.1.2.1 Cable Preparation for Termination	Visual	100% In Process	No Conductor Damage No Separation Of Plating
7.6.1.2.2 Orientation During Threading		100% In Process	
7.6.1.2.3 Conductor Threading		100% In Process	
7.6.1.2.4 Conductor Folding	Visual 5X Magnification		

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.6.1.3 Molding			
7.6.1.3.1 Environmental Requirements		Bimonthly	
7.6.1.3.2 Verify Manufacturing Steps		100% In Process	
7.6.1.3.3 Molding Sample			
a. Dimensions	Visual	Sample	MIL-C-55544
b. Porosity	Visual	Sample	Fed. Test Std. 406, Method 5021
7.6.1.4 Finishing			
7.6.1.4.1 Verify			
a. Clean Molded Body	Visual	100% In Process	
b. Flash	Visual	100% In Process	None Allowable

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
c. Excess Material	Visual	100% In Process	None Allowable
d. Contamination	Visual 5X Magnification	100% In Process	None Allowable
7.6.1.4.2 Potting			
a. Potting Compound Preparation		100% In Process	See Manufacturers Instructions
b. Air Bubbles During Mixing	Visual	100% In Process	Degas Until no Bubbles Are Visible
c. Air Bubbles	Visual 5X Magnification	100% In Process 10 Min After Potting	No Surface Bubbles Visible
d. Fabricate Test Specimen		Fabricate for Each Lot	
e. Surface Quality	Visual	100% In Process	See Test Paragraph 7.8

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
f. Potting Separation	Visual	100% In Process	Shore D25 \pm 2
g. Hardness	Durometer	100% for Each Lot or Control Specimen	
7.6.2 Inspection of Cylindrical Plugs			
7.6.2.1 Receiving Inspection of Plug Material			
7.6.2.1.1 Potting Compound (See Paragraph 7.4.4)			
7.6.2.2 Parts Assembly			
7.6.2.2.1 Cable Stripping	Visual	100% In Process	Conductor Expo- sure 0.425 in.
7.6.2.3 Molding (See Paragraph 7.6.1.3)			

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.6.2.3.1 Environmental Requirements	Visual See Paragraph 7.6.1.3.3(b) See Paragraph 7.6.1.4	Sample	MIL-C-55544 & NASA Drawing 50M72607
7.6.2.3.2 Molding Sample			
a. Dimensions			
b. Porosity			
7.6.2.4.4 Finishing	Visual Visual 5X Magnification	100% In Process 100% In Process	No Bends, Kinks, etc. No Plating Separation
7.6.3 Inspection & Test of Premolded Plug Flat Cable Assembly (Unshielded)			
7.6.3.1 Conductor Insertion Damage	Visual 5X Magnification	100% In Process	No Bends, Kinks, etc. No Plating Separation
7.6.3.2 Conductor Folding Damage			

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.6.3.3 Wedge Insertion	Visual	100% In Process	See Figure 7-5, View A
7.6.3.4 Potting Base of Plug	Visual	100% In Process	See Figure 7-5, View B
7.6.3.5 Installation of Silicone Rubber Seal	Visual	100% In Process	See Figure 7-5, View C
7.6.4 Special Terminations			
7.6.4.1 Inspection of Flat Cable Conductors to Grounding Terminations			
7.6.4.1.1 Strip Cable Ends	See Paragraph 7.5.2		
7.6.4.1.2 Clean Conductors and Ground Lug	Visual 10X Inspection	100% In Process	No Signs of Oxidation, etc.
7.6.4.1.3 Tinning and Soldering Conductor and Ground Lug	Visual	100% In Process	MIL-S-45743

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.6.4.1.4 Epoxy Application	Visual	100% In Process	See Paragraph 7.6.4.1.4
7.6.4.1.4 Epoxy Application			
7.6.5 Inspection of Flat Con- ductor Cable to Round Wire Transitions			
7.6.5.1 Conductor Preparation			
7.6.5.1.1 Flat Conductor Cable Stripping (See Paragraph 7.5.2)	Visual	100% In Process	MIL-S-45743 0.375 ± 0.030-Inch Strip No Oxidation Visible
7.6.5.1.2 Round-Wire Stripping			
a. Quality Requirements b. Dimensions			
7.6.5.1.3 Cleaning	10X Magnification	100% In Process	

TABLE 7-1. INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Continued)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.6.5.1.4 Conductor Soldering	Visual	100% In Process	MIL-S-45743
7.6.5.1.5 Potting	Visual	100% In Process	MSFC-PROC-196
7.7 Final Inspection and Test of Assembled Cable and Plug			
7.7.1 Visual/Mechanical			
a. Verify All Previous Inspection Points		100%	See Applicable Sections
b. Inspect for Cleanliness	Visual	100%	Extraneous material Unacceptable
c. Conductor Cleanliness	10X Magnification	100%	No Visible Oxidation
d. Mechanical Mating	Mate With Approp- riate Receptacle	100%	(1) Smooth Positive Operation (2) No Conductor Damage (3) No Gasket Damage
7.7.2 Electrical			

TABLE 7-1 INSPECTION AND TEST OUTLINE FOR FLAT CABLE ASSEMBLY
MANUFACTURING (Concluded)

Reference Paragraph and Inspection Parameter	Method of Inspection	Inspection Interval	Acceptance Criteria
7.7.2.1 Unshielded Systems			
a. Conductor Continuity	See Figure 7-6	100 %	All Conductors Continuous
b. Conductor to Conductor Leakage	See Figure 7-6	100 %	
c. Dielectric Voltage Test	MIL-Std-202	100 %	MIL-C-55544
7.8 Installation of Flat Cables, Inspection and Test Requirements			
7.8.1 Installation of Supports and Clamps			
a. Attach Area Clean	Visual	100 %	Free of Oxidation, etc.
b. Alignment	Visual	100 %	
c. Clamp Placement	Visual	100 % In Process	
7.8.2 Flat Cable Harness Preparation			
7.8.2.1 Folding	Visual	100 % In Process	
7.8.3 Routing Cable Bundles	Visual	100 %	

7.4 Receiving Inspection

7.4.1 Cable Inspection and Test

7.4.1.1 Identification. The cable, as received, shall be identified in accordance with MIL-C-55543. Each cable roll shall be inspected for proper identification, and information shall be recorded in a receiving log for a permanent record as follows:

DATE RECEIVED	PART NUMBER LOT NUMBER	MANUFACTURE CODE	DATE OF MANUFACTURE
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A sample of a convenient length, 6 or 8 inches from each lot received, should be extracted and filed with the receiving and inspection record.

7.4.1.2 Certification of Conductor Material (Shielded and Unshielded). With each shipment of cable, certification of conductor material should be provided by the manufacturer. This information should be filed with the receiving and inspection record.

7.4.1.3 Packaging and Packing Inspection (Shielded and Unshielded). Cables should be received in a condition in accordance with MIL-C-12000. Minimum acceptable lengths for various cable widths shall conform with the requirements outlined in MIL-C-55543.

7.4.1.4 Cable Dimensions (Unshielded). Inspection of cable dimensions on the receiving level should be divided into three inspection areas:

- a. Cable width
- b. Conductor spacing and alignment
- c. Conductor cross-section

All dimensions taken should correspond with the specification sheets of MIL-C-55543. Any variance from these dimensions should be considered a major defect and cause for rejection. Part of these measurements, for unshielded cable, can be checked on a conceptual device as shown in Figure 7-1.

The device illustrated is not presently available, but is a recommended approach for inspecting large quantities of bulk cable. Inspection of FCC by other means can be implemented using the principles of this device.

7.4.1.4.1 Cable Width. Cable widths can be measured on the device shown in Figures 7-1 and 7-2. The entire roll can be checked for width dimensions upon each receipt by observing the gage on the device shown. The need for a 100-percent inspection level can be eliminated after a confidence level has been reached assuring the cable adheres to the requirements of MIL-C-55543. An appropriate sampling plan can then be initiated.

7.4.1.4.2 Conductor Spacing and Alignment. Variance in conductor spacing and alignment can be detrimental to the operation of the cable, particularly when used in RF applications. Checking for spacing and alignment for unshielded cable for both polyester and polyimide can be done visually using the device shown in Figure 7-1. By passing the cable by a standard gradient, which is placed at a relatively small angle to the horizontal, a moire pattern is formed. This pattern, if observed carefully, will change if conductor alignment is not correct. See Figure 7-2 for particulars.

When any change in the pattern occurs, an exact measurement of the spacing can be taken and recorded. Depending upon the extent of the defect, that portion of the cable roll can be rejected. All cable spacing should adhere to the requirements of MIL-C-55543.

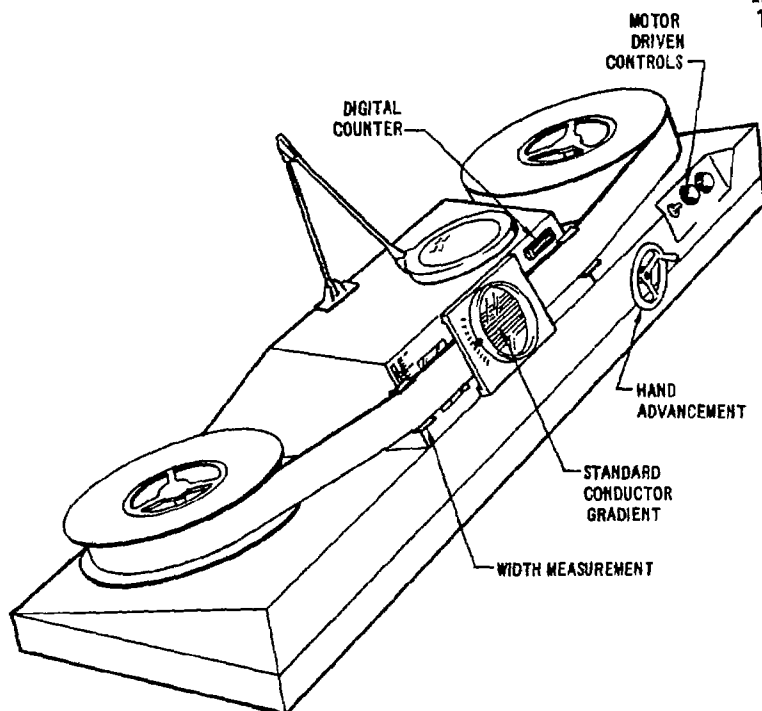


FIGURE 7-1. Flat cable inspection device.

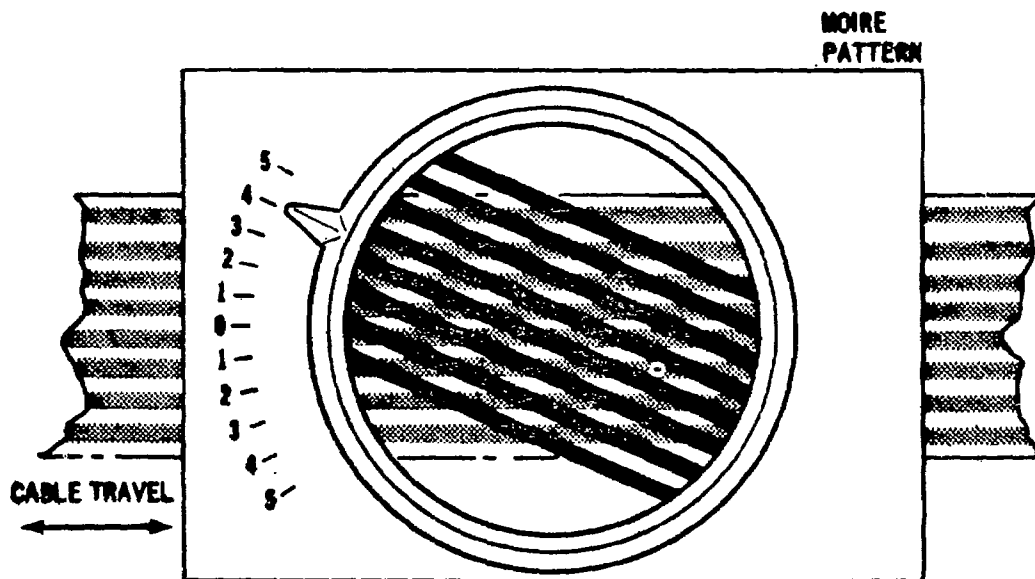


FIGURE 7-2. Unshielded conductor viewing screen.

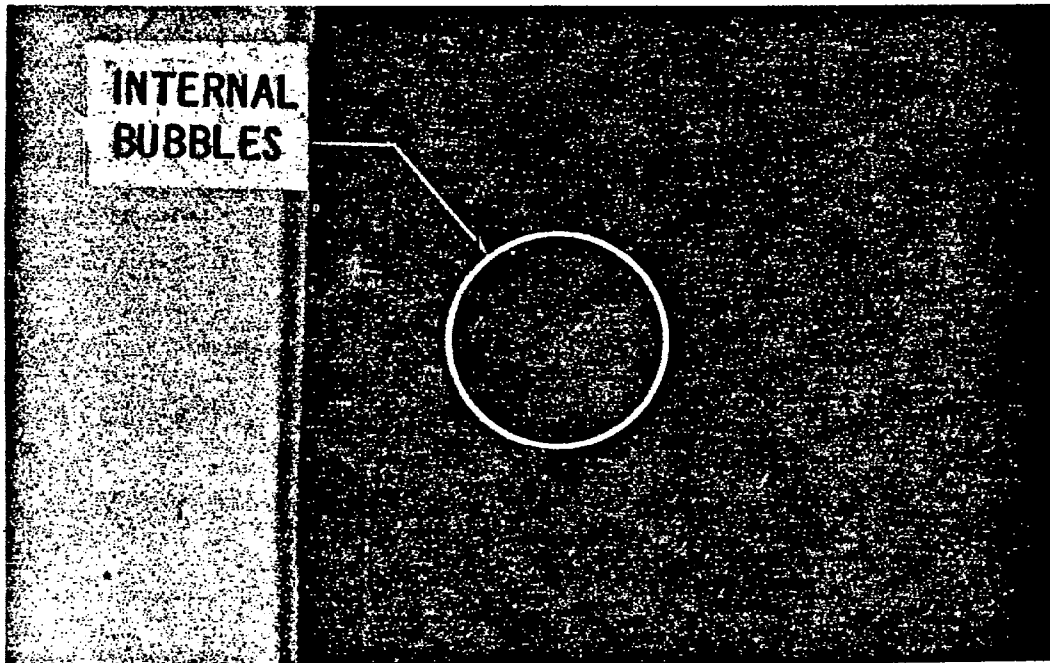


FIGURE 7-3. Internal bubbles polyimide/FEP shielded cable.

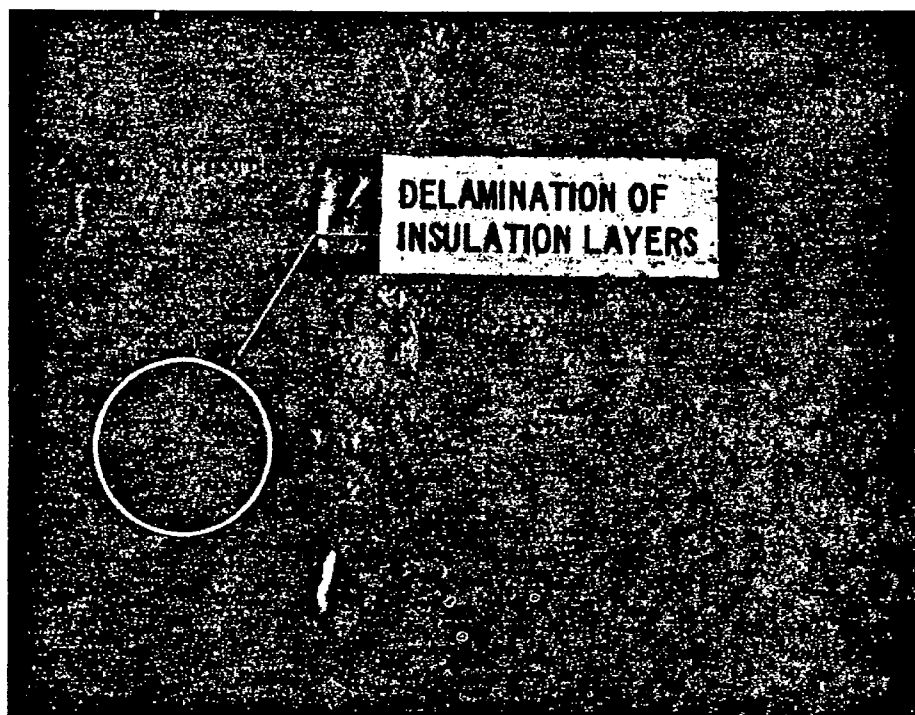


FIGURE 7-4. Delamination of insulation layers.

7.4.1.5 Cable Inspection (Shielded). The checking of the spacing alignment and conductor width of shielded cable (Figure 7-10) cannot be accomplished by the visual method as suggested in Paragraph 7.4.1.4. An X-ray approach to check conductor alignment is therefore suggested for a quick look at conductor profile.

A sampling plan should be initiated to X-ray check specific lengths of cable.

A table-top radiograph device that incorporates a polaroid camera for quick processing of radiographic prints can be utilized. The film can be then analyzed for conductor width and spacing alignment.

7.4.1.5.1 Flat Cable Testing with Time-Domain Reflectometry. Time-domain reflectometry is a system of utilizing pulse reflections to locate discontinuities along cables. A pulse-by-pulse burst is sent continuously down the cable under investigation, and the reflected signals are monitored on a scope. This method enables the user to view the characteristic impedances of the cable. It also will provide both the position and the nature (resistive, inductive, or capacitive) of each discontinuity.

This system may be particularly helpful in the inspection of shielded-cable geometry. Any variance in conductor or shield spacing in modes A, B, and C, as indicated in Figure 7-11 may be detected with the proper equipment.

Further information on time-domain reflectometry and applications can be found in the following publications:

Hewlett Packard Application Note 62, "Time Domain Reflectometry,"
Hewlett Packard Co., 1964

H & P Application Note 67, "Cable Testing with Time Domain,"
H & P Co., 1965

Tektronix Service Scope No. 45, "Time Domain Reflectometry Theory
and Coaxial Cable Testing," Tektronix, Inc., Aug. 1967.

With time-domain reflectometry each of the modes shown, A, B, and C, (Fig. 7-11), can be inspected without extracting a sample from a cable roll.

7.4.1.6 Workmanship (Polyester and Polyimide Cable). The cable, from an overall quality standpoint, should be inspected over its entire length. Unsatisfactory conditions that may exist are as follows:

7.4.1.6.1 Air bubbles - Below the surface of the insulation (Fig. 7-3).

7.4.1.6.2 Delamination - Separation of insulation material from the conductors (Fig. 7-4).

7.4.1.6.3 Broken conductors.

7.4.1.6.4 General damage - Kinks, abrasions, cracks, dents, etc.

The preceding defects can be cause for rejection if they adversely affect the serviceability of the cable. Identification of visible defects can be accomplished on a device shown in Figure 7-1. The entire length of cable can be checked quickly by passing it over the light source and viewing it under an ample magnification. Gross defects can be identified and marked on the cable with a grease pencil for later analysis. Both sides of the cable should be inspected.

If defects to the insulation are numerous, i.e., pits, bubbles, etc., an additional test may be performed. This test is defined in Federal Test Method Standard No. 228, Method No. 6211. The test consists of passing the cable over an electrode, wet sponge, for detection of insulation flaws.

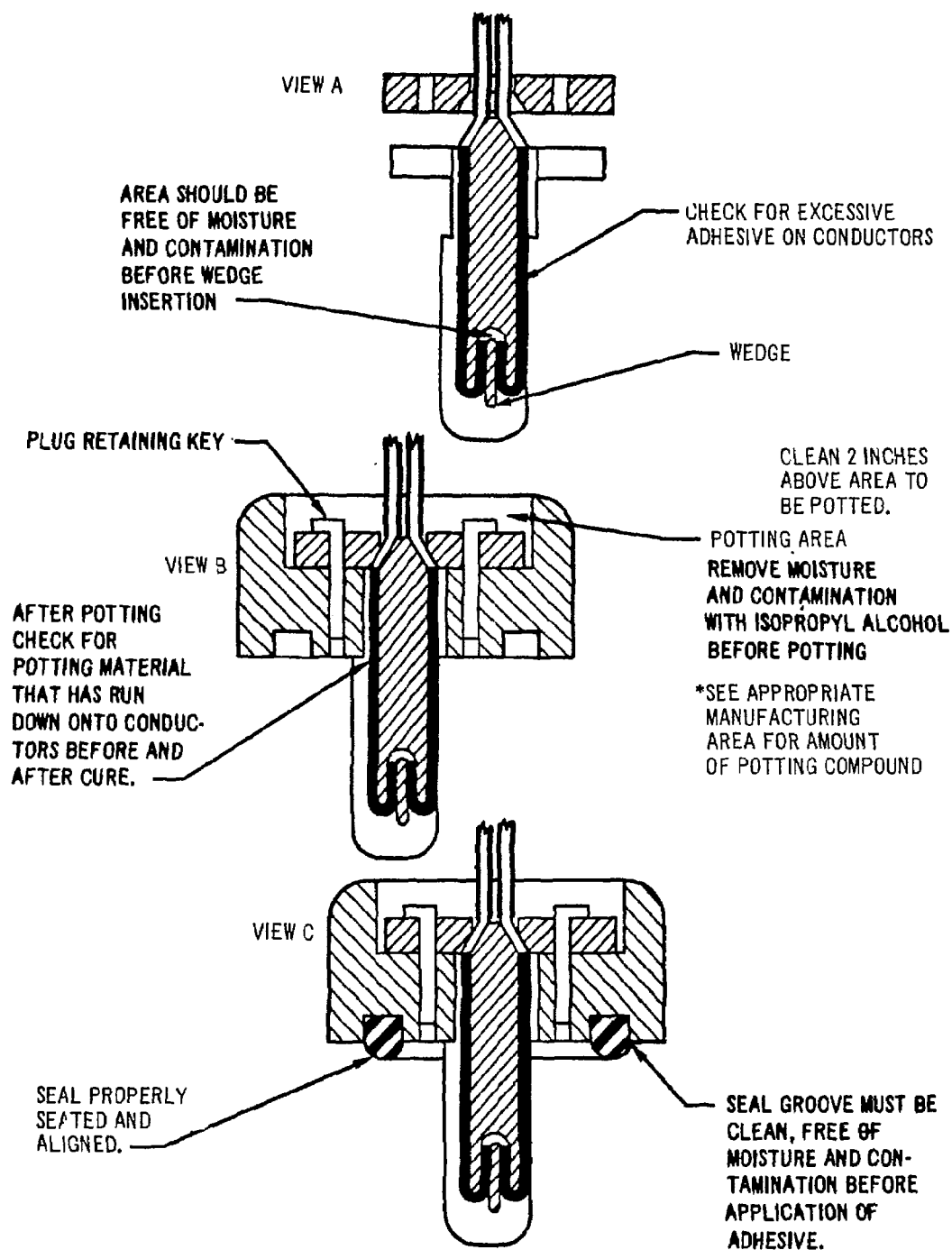


FIGURE 7-5. Unshielded premolded plug inspection.

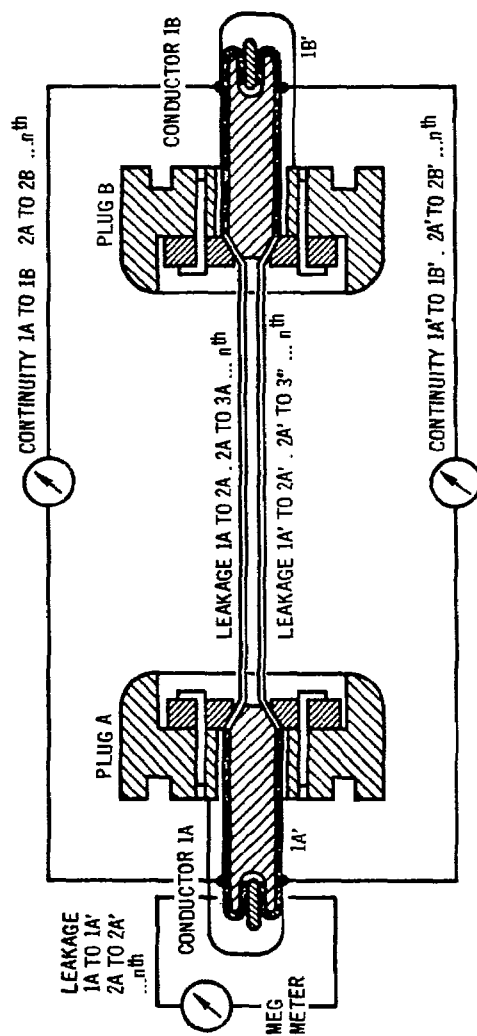


FIGURE 7-6. Unshielded system.

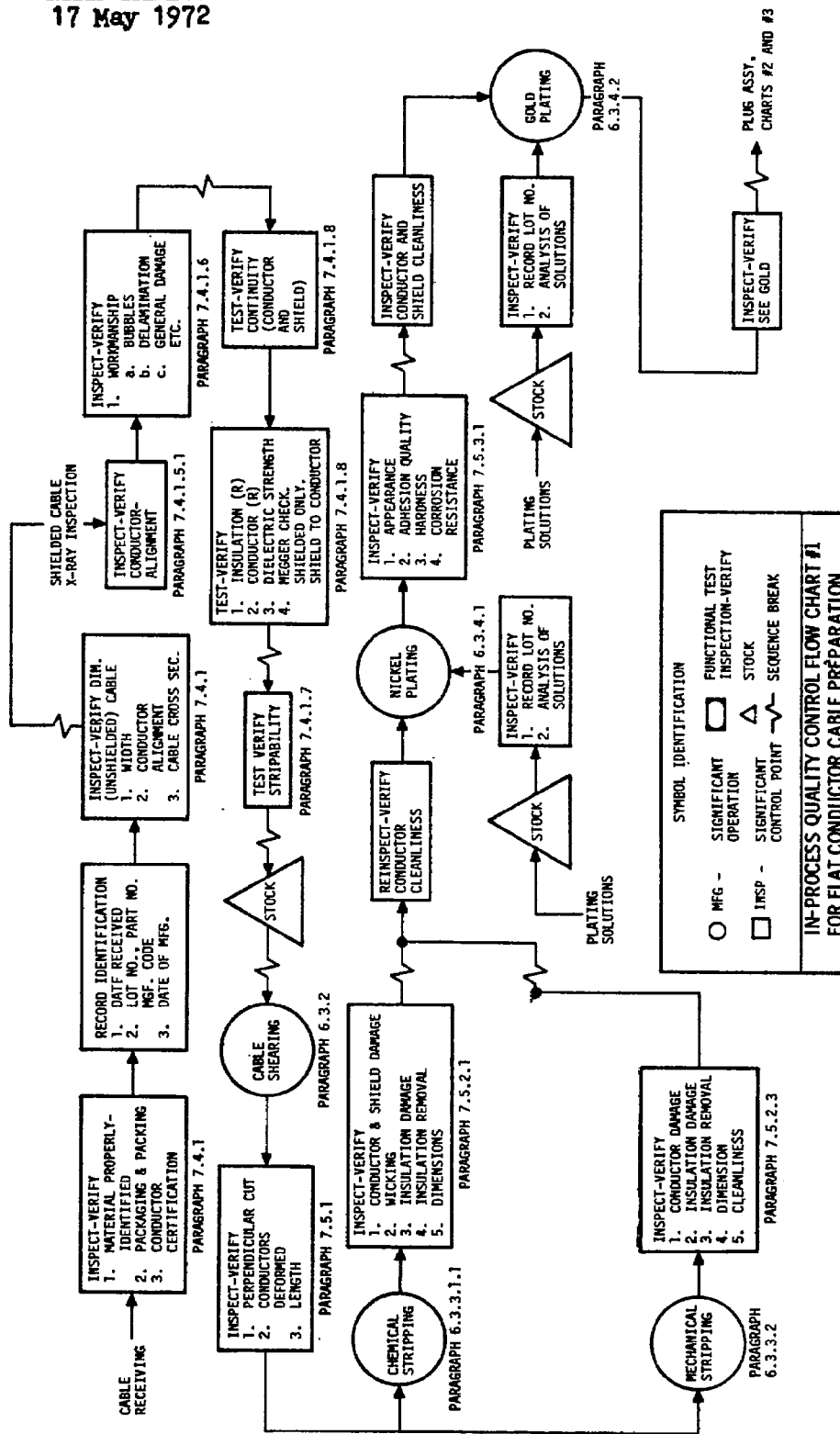


FIGURE 7-7. In-process quality control flow chart for FCC preparation.

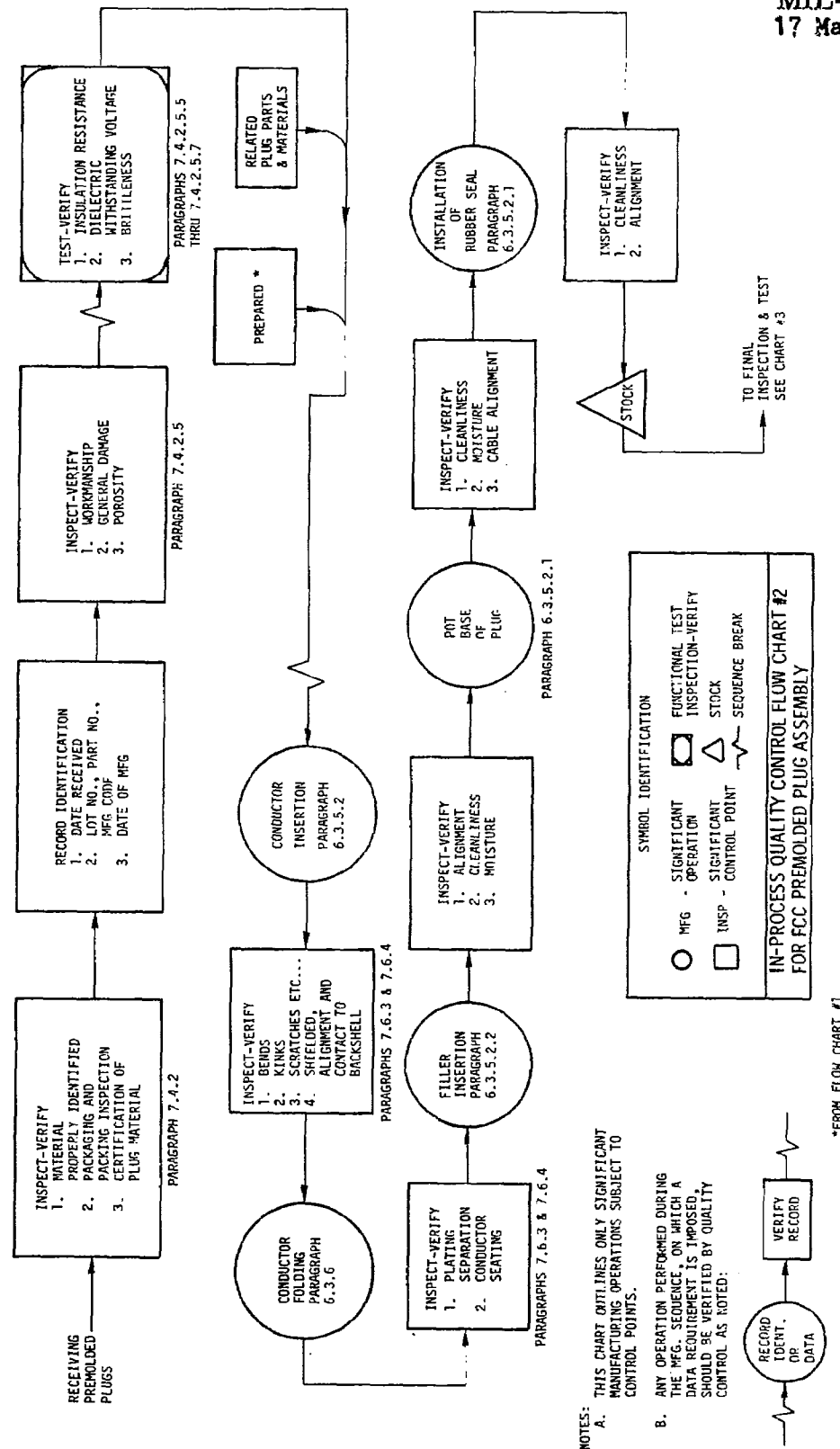


FIGURE 7-8. In-process quality control flow chart for FCC premolded plug assembly.

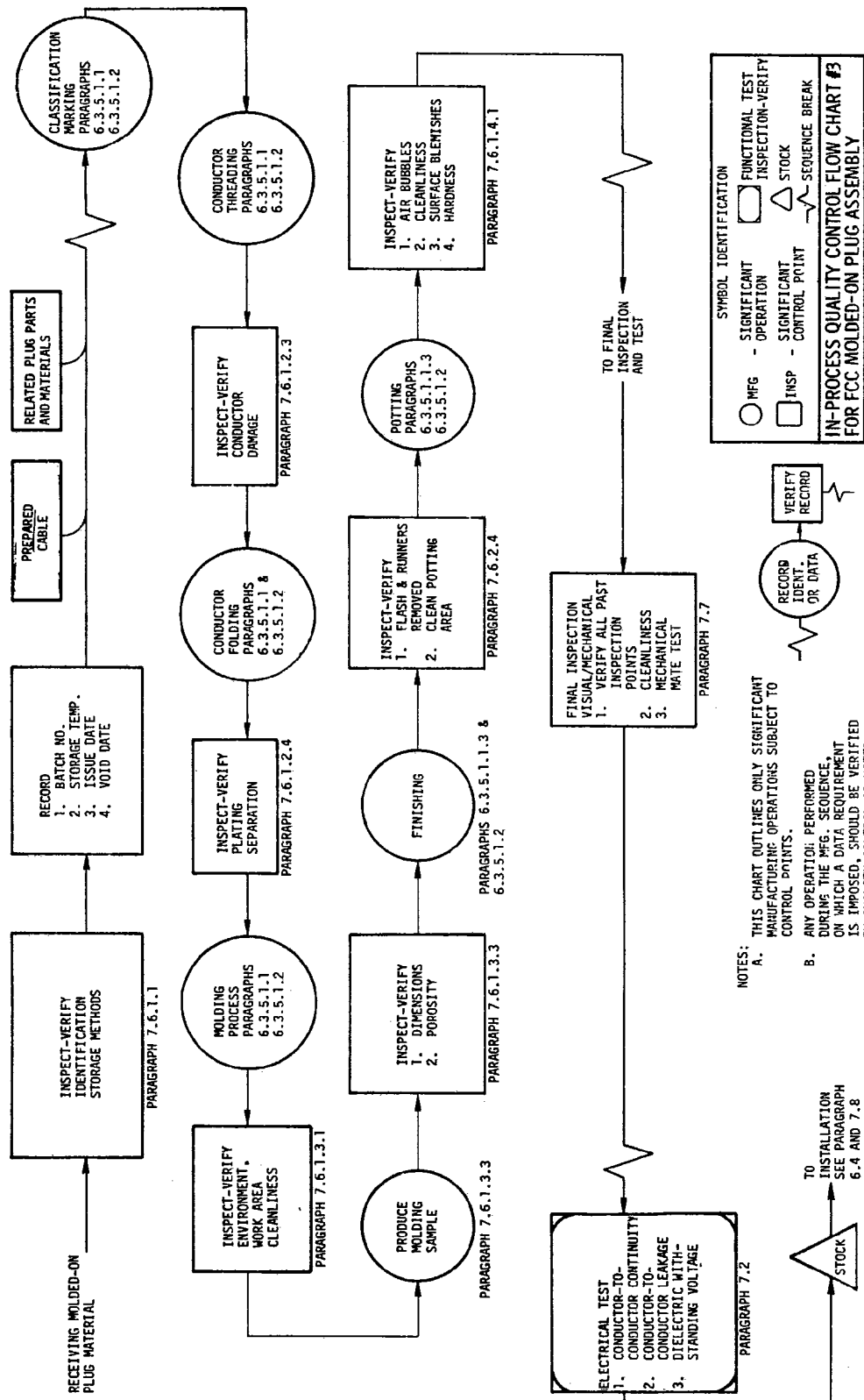


FIGURE 7-9. In-process quality control flow chart for molded-on plug assembly.

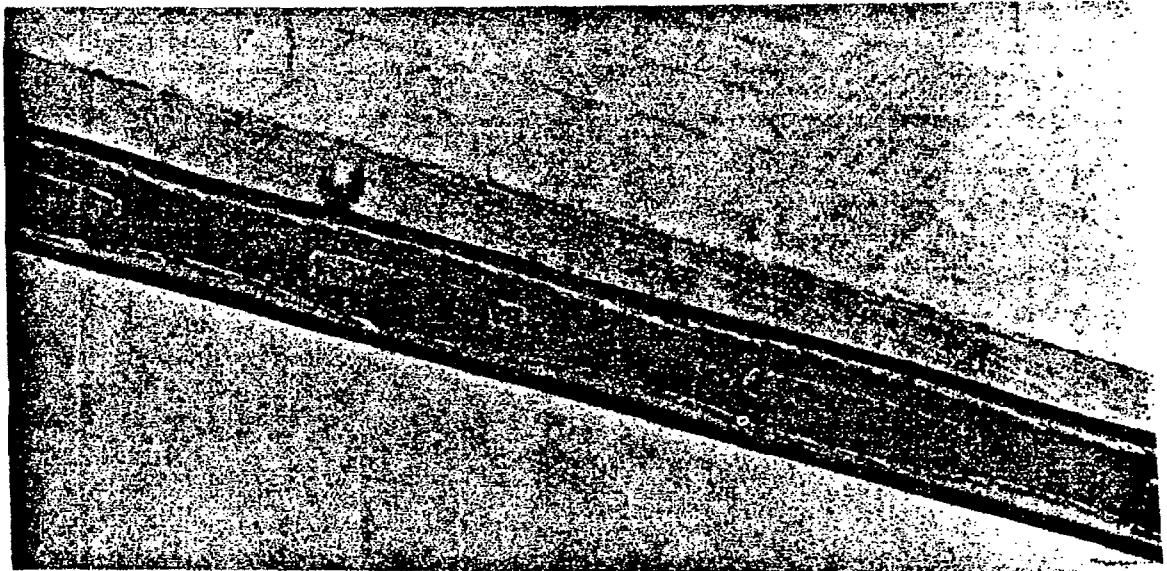


FIGURE 7-10. Cross-section shielded polyimide/FEP cable.

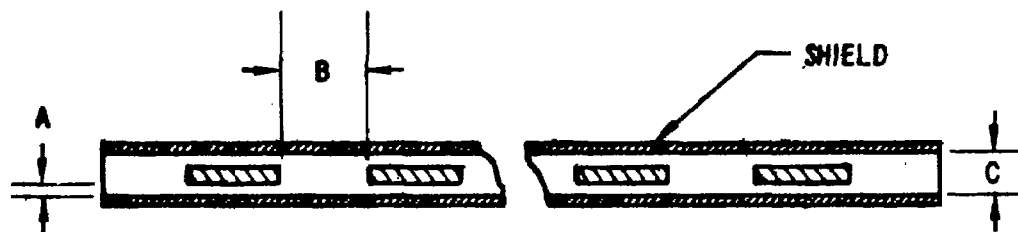


FIGURE 7-11. Cross-section shielded cable.

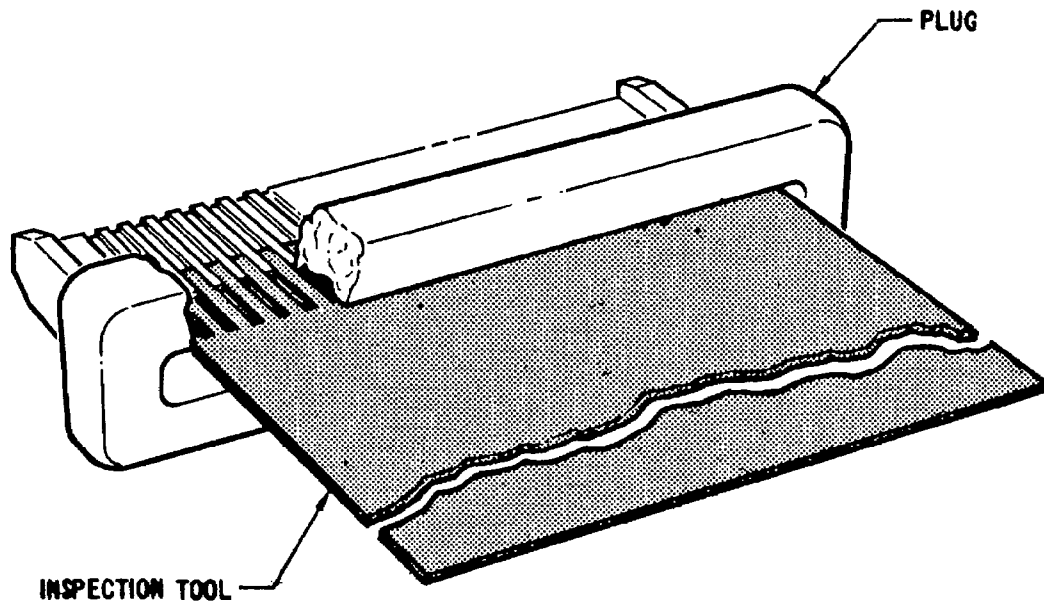


FIGURE 7-12. Plug window dimensional inspection tool and flash remover.

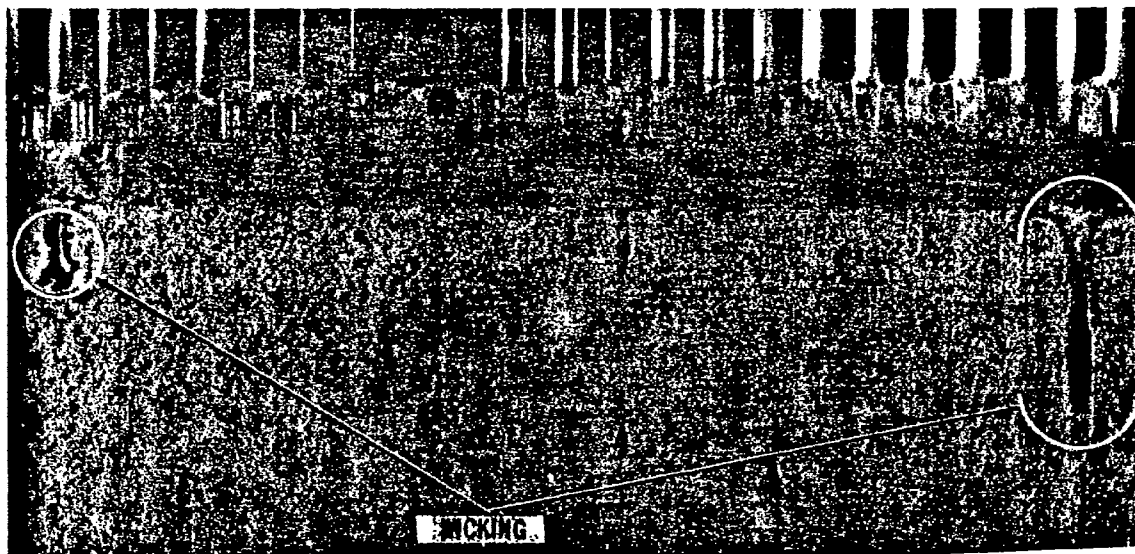


FIGURE 7-13. Chemical wicking.

7.4.1.7 Stripability. To determine before production if the cable received is stripable, a sample should be extracted and stripped according to the standard stripping methods of Section VI.

7.4.1.8 Receiving Inspection (Electrical Test).

7.4.1.8.1 Cable Electrical Continuity. Cable electrical continuity should be inspected on a 100-percent basis. Both ends of the cable roll should be stripped, and a continuity check should be made on each conductor.

7.4.1.8.2 Insulation Resistance. A sample should be cut from the end of the cable roll and tested per MIL-C-55543.

7.4.1.8.3 Conductor Resistance. The dc resistance of the individual conductors should be taken on a sample basis and tested in accordance with Federal Test Method Standard No. 228, Method No. 6021.

7.4.1.8.4 Dielectric Strength. A sample roll from each inspection lot should be subjected to the dielectric test per MIL-C-55543.

7.4.2 Receiving Inspection Premolded Plugs (Shielded and Unshielded).

7.4.2.1 Identification. The plugs as received should be identified properly in accordance with MIL-STD-129D. Each shipment should be inspected for proper identification, and information should be recorded in a receiving log for a permanent record as follows:

DATE RECEIVED	MANUFACTURING CODE	DATE OF MANUFACTURE
------------------	-----------------------	------------------------

7.4.2.2 Material Certification. Certification of plug material should be provided by the manufacturer with each shipment of plugs and filed with each receiving and inspection record.

7.4.2.3 Packaging and Packing Inspection. Connector plugs should be received in a condition in accordance with MIL-D-116. Preservation and packing should be as the contract or purchase order requires. Specifics may be found in MIL-C-55544.

7.4.2.4 Plug Dimensions. An appropriate sampling plan should be initiated to check critical plug dimensions. All dimensions should comply with MIL-C-55544; any variance from these dimensions should be considered a major defect.

The sampling plan initiated should include sectioning of the plug to inspect critical internal dimensions.

An inspection tool, similar to the one illustrated in Figure 7-12, can be used to inspect the plug window area. The tool serves two purposes: (1) a quick dimensional check, and (2) a flash-removal device used by Manufacturing.

7.4.2.5 Workmanship. Overall quality of the plug should be checked in the following areas:

7.4.2.5.1 Flash. Flash, or excessive material on the plug, can be particularly critical if it exists in the plug window area. An appropriate sampling plan to identify this defect cannot be overstressed. The tool illustrated in Figure 7-12 can be utilized. If the insertion of the tool is rough and not smooth, flash may exist. The plug should then be identified and reworked or rejected.

7.4.2.5.2 General Damage. The received plug should be inspected, on a sample basis, for general damage (cracks, nicks, etc.).

7.4.2.5.3 Porosity. A sample should be taken from each inspection lot and sectioned for porosity inspection. The cut section should be viewed for porosity under 5X magnification. The complete procedure for porosity identification is defined in Federal Test Standard No. 406, Method No. 5021.

7.4.2.5.4 Plug Material Testing. Specific parameters to ensure consistent material quality should be checked on an inspection-lot basis until a reasonable confidence level has been reached. The test are as follows:

7.4.2.5.5 Insulation Resistance. For procedure, see Federal Standard No. 406, Method No. 4041.

7.4.2.5.6 Dielectric Withstanding Voltage. See Federal Test Standard No. 406, Method No. 4031.

7.4.2.5.7 Brittleness. See Federal Test Standard No. 406, Method No. 2051.

7.4.3 Receiving Inspection of Related Plug Materials.

7.4.3.1 Premolded Plug Wedge and Retainer.

7.4.3.1.1 Dimensions. Initiate a sampling plan to check critical dimensions. Dimensions are found in MIL-C-55544.

7.4.3.1.2 Material Testing. Same as plug material testing (See Paragraph 7.4.2.5.4).

7.4.3.2 Gasket.

7.4.3.2.1 Dimensions. Initiate sampling plan to check overall dimensions.

7.4.3.2.2 Hardness. Check the gasket for hardness using durometer shore (A). Hardness should be Shore A78 \pm 3.

7.4.3.2.3 Age Control and Storage. The age and storage control of gasket material should be in accordance with MSFC-STD-105.

7.4.4 Molding Compounds, Potting Compounds, and Adhesives Control. The general requirements for storage and in-plant control of the plating compounds and adhesives, as referenced in Section VI, are specified herein.

7.4.4.1 Identification and Storage. The identification and storage requirements are as follows:

- a. Issuance of materials should be on a first-in, first-out basis.
- b. Materials should be stored per manufacturer's instructions.
- c. All bulk materials should be labelled and identified, and stored and handled per manufacturer's instructions. Label as follows:

Perishable Item

Batch No. (Vendor's batch or lot numbers)
Stored At (Storage temperature)
Issue Date (Date material issued from storage)
Void After (Expiration date after testing and storage)

7.4.4.2 Storage Surveillance. The storage surveillance requirements are as follows:

- a. Materials which have aged beyond the void date should be impounded and retested.
- b. Materials should be reidentified with a new expiration date, if tested and found acceptable.
- c. Records of periodic storage surveillance should be maintained.

7.4.5 Receiving Inspection - Receptacles.

7.4.5.1 FCC to FCC Rectangular Receptacle.

7.4.5.1.1 Identification. The receptacles, as received, will be identified in accordance with MIL-C-55544 and MIL-STD-129. Each shipment should be checked for proper identification, and the information should be recorded in a receiving log as follows:

DATE RECEIVED	MANUFACTURING CODE	DATE OF MANUFACTURING
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7.4.5.1.2 Packaging and Packing. Connector receptacles, as received, should be in accordance with MIL-P-116. Preservation and packing should conform to the requirements of the contract or purchase order. Requirements are defined in MIL-C-55544.

7.4.5.1.3 Dimensions. An appropriate sampling plan should be initiated to inspect critical receptacle dimensions. All dimensions should comply with MIL-C-55544; any variances in tolerances should be considered a major defect. Measurement of contact spacing and size should be made using a standard gauge and inserting it into the receptacle.

7.4.5.1.4 General Damage. The receptacle, as received, should be reviewed for any damage, cracks, nicks, etc. Particular attention should be paid to contact pins, checking for bends, etc.

7.4.5.1.5 Material Identification. With each shipment, shell material, contact material, retainer clip, and gasket material should be certified by the manufacturer. This information should be filed with the receiving inspection record. Material requirements are defined in MIL-C-55544.

7.4.5.1.6 Material Finish. Finish requirements for the shell and contact material are defined in MIL-C-55544. A sample plan should be initiated to verify these finishes.

7.4.5.1.7 Mating and Unmating Forces. Receptacles should be capable of being mated and unmated with applicable plugs without the use of any special tool. The force required either to engage or separate the plug and receptacle should not exceed the maximum force specified in the appropriate table of MIL-C-55544. An appropriate sampling plan should be initiated for inspection of this parameter.

7.4.5.1.8 Electrical.

7.4.5.1.8.1 Contact Resistance. Initiate a sampling plan to measure contact resistance in accordance with method 307 of MIL-STD-202. MIL-C-55544 gives the individual millivolt drop values.

7.4.5.1.8.2 Low-Level Contact Resistance. Initiate a sampling plan to measure low-level contact resistance per MIL-C-55544. Reference MIL-C-55544 for specific values.

7.4.5.2 FCC to RWC Rectangular Receptacle. Reference Paragraphs 7.4.5.1.1 through 7.4.5.1.8.2 and MIL-C-55544 for specifics.

7.4.5.3 FCC to FCC Cylindrical Receptacle. Reference Paragraphs 7.4.5.1.1 through 7.4.5.1.8.2 and MIL-C-55544 for specifics.

7.4.5.4 FCC to RWC Cylindrical Receptacle. Reference Paragraphs 7.4.5.1.1 through 7.4.5.1.8.2 and MIL-C-55544 for specifics.

7.4.6 Receiving and Inspection of Clamps and Supports.

7.4.6.1 Identification. The clamps received should be identified per MIL-STD-129. Each shipment should be inspected for proper identification and recorded in a receiving log.

7.4.6.2 Packaging and Packing Inspection. FCC clamps received should be in accordance with MIL-P-116. Preservation and packing received should conform to the contract or purchase order requirements.

7.4.6.3 Dimensions. A sample plan should be initiated for inspecting clamp dimensions per applicable drawing.

7.4.6.4 Workmanship. The clamping device should be inspected for the following:

- a. General damage.
- b. Plating consistency (if required).
- c. Spring tension (if incorporated).
- d. Cushion hardness - The rubber used on the clamp should be subjected to a durometer Shore inspection to determine if the cushion hardness is within tolerance.

7.5 In-Process Inspection and Test of Cable Preparation for Termination

The inspection requirements for preparing cable for termination will be discussed in this section. The three basic steps, shearing, stripping, and plating, will be elaborated upon. The particular stripping method used will depend upon what cable type is used. Reference the appropriate manufacturing section for the determining stripping methods.

7.5.1 Cable-Shearing Inspection (Reference Section VI, Paragraph 6.3.2). Three major parameters should be inspected before the cable can be stripped. These parameters are:

- a. The shear must be cut perpendicular to the conductor.
- b. The conductor ends should not be deformed. Inspection under a magnifying glass of ample power should be performed for identification of deformed conductor ends.
- c. The length of the sheared cable should be accurate.

7.5.2 Cable-Stripping Inspection.

7.5.2.1 Chemical Stripping - Polyester and Polyimide Unshielded and Shielded Cables (Reference Section VI, Paragraph 6.3.3.1.1). Chemical stripping of both polyester and polyimide cable consists of the same general inspection procedures. These procedures are as given in the following paragraphs.

7.5.2.1.1 Conductor Damage. Check for oxidation and contamination of conductors. If contamination is found, check the chemical stripping solutions for foreign material and contamination.

7.5.2.1.2 Wicking. Wicking (Fig. 7-13) is the capillary action of the stripping solution to travel past the strip line between the cable conductors and the insulation. Wicking can be prevented if strict adherence to the precautionary measures defined in Section VI are taken.

Any sign of wicking, after inspection under 5X magnification, shall be cause for rejection.

7.5.2.1.3 Insulation Damage. Any chemical degradation of insulation material beyond the designated area of strip should be cause for rejection. The strip line should be clean and straight, and no tape adhesive should remain on and around the strip line.

7.5.2.1.4 Complete Insulation Removal. The stripped cable should be carefully checked for any residual insulation on, or between, the conductors. Inspection of the conductors at this point cannot be overly stressed. Each conductor should be checked individually under a magnification of 10X power. Any residual insulation found should be identified and removed per instructions in Section VI, Paragraph 6.3.3.

7.5.2.1.5 Dimension of Strip. Each stripped cable should be measured for proper strip length. The strip lengths will vary depending upon the type of plug being used, rectangular molded-on, or premolded, or cylindrical. These dimensions may be found in the manufacturing section pertaining to plugs.

7.5.2.2 Mechanical Stripping (Reference Section VI, Paragraph 6.3.3.1.2). The inspection and test requirements for stripping cable by using the following stripping tools are basically the same. Reference the appropriate manufacturing section for specifics.

- a. NASA cold stripper - Section VI, Paragraph 6.3.3.2.1.
- b. NASA plane stripper - Section VI, Paragraph 6.3.3.2.2.
- c. Gore stripper - Section VI, Paragraph 6.3.3.2.3.
- d. Viking FCC stripping machine - Section VI, Paragraph 6.3.3.2.4.
- e. Rush FCC stripping machine - Section VI, Paragraph 6.3.3.2.5.
- f. Carpenter FCC stripping machine - Section VI, Paragraph 6.3.3.2.6.

7.5.2.2.1 Conductor Damage. The above stripping devices employ either a knife blade for stripping or an abrasive wheel for removing of insulation. Particular attention must be given to conductor damage that may be caused by the knife blade, excessive heat, or abrasive. The conductors, under an ample magnification, should be observed for:

- a. Nicks, scratches, abrasions, and bends (Fig. 7-14).
- b. Plating defects.
- c. Conductor heat damage, oxidation, etc.

7.5.2.2.2 Complete Insulation Removal. The stripline should be even, and clean and free of all residual insulation or bonding agents. No insulation should be left between the conductors. Each conductor should be checked under magnification for residual insulation or bonding agents. If the insulation is not properly removed, samples should be run on the particular stripping device being used to determine the appropriate stripping pressure to effectively strip the cable. The bond strength from cable to cable may vary; therefore, it will be necessary at times to perform the task just described. Figure 7-15 shows an example of uneven stripping and excessive insulation between stripping conductors.

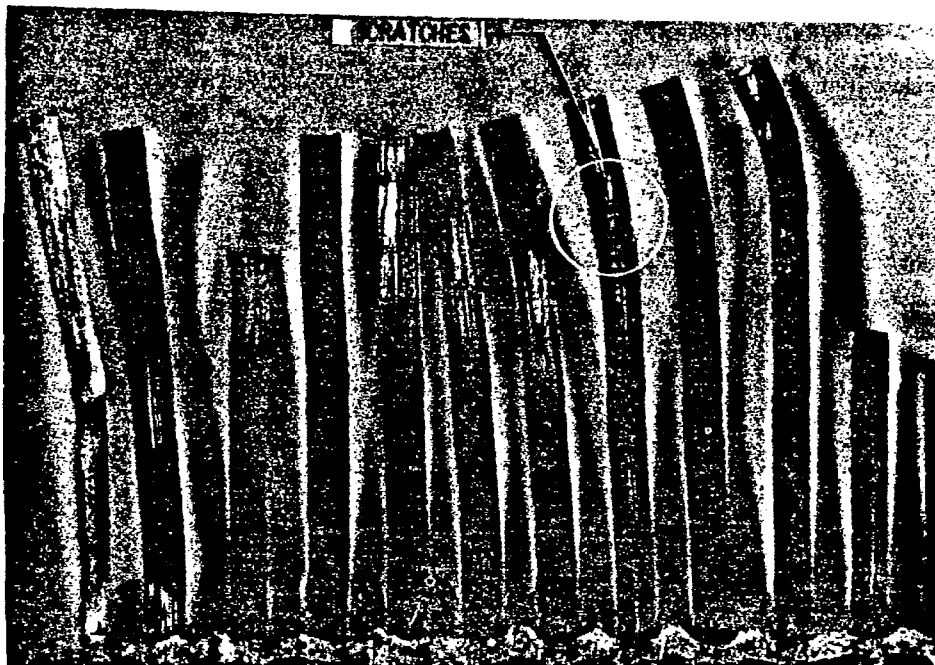


FIGURE 7-14. Scratches, nicks, and bends of conductors.

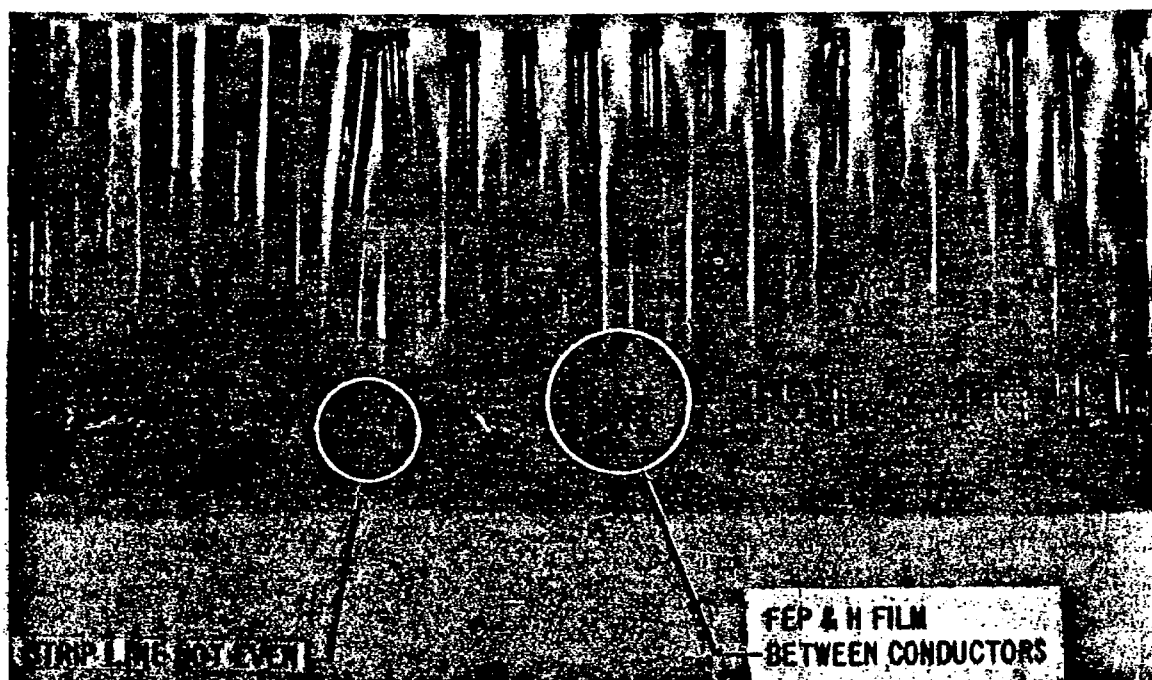


FIGURE 7-15. Polyimide and FEP between conductors.

7.5.2.2.3 Conductor and Insulation Cleanliness. Each conductor should be inspected for cleanliness after stripping, particularly in the case of abrasive stripping. Inspect for metal particles on the conductors or that may have been embedded in the insulation between conductors. The particles can cause short circuits during the electroplating process that follows stripping.

7.5.2.3 Acceptable Stripped Cable. Figure 7-16 is presented to provide visual information in recognizing an acceptable strip. Pay particular attention to the appearance of the conductors and strip line.

7.5.3 Conductor and Shield Plating (Reference Section VI, Paragraph 6.3.4). The inspection procedure for nickel and gold plating of cable conductors and shields is as follows:

7.5.3.1 Nickel Plating (Reference Section VI, Paragraph 6.3.4.1).

7.5.3.1.1 Conductor Inspection. Inspection of the conductors before plating is particularly critical. Each one of the conductors should be reinspected if a period of time has lapsed between the stripping and plating operation. Excessive oxidation and general conductor damage, as discussed in the stripping procedure, is unacceptable. Proper precautionary measures should be taken at all times to protect the conductors from damage and corrosion.

7.5.3.1.2 Appearance.

a. The nickel plating should be smooth, adherent, and free from blisters, laminations, nodules, pits, discontinuities, and porosity. Inspection under a magnification of 5X should be used to identify these defects.

b. The line of demarcation between plated and unplated areas shall be even and smooth.

7.5.3.1.3 Thickness. The thickness should be minimum of 0.000,050 inch unless otherwise specified. A section taken on a sample basis should be microphotographed for measurement purposes.

7.5.3.1.4 Adhesion. A plated sample cable should evidence no separation of plate from conductor after bending 180 degrees around a 1/8-inch rod.

Each time the plating solution is renewed, a sample should be plated before actual production begins, checking for adhesion quality.

7.5.3.1.5 Corrosion Resistance. A plated conductor sample should evidence no corrosion of base metal after 2 hours of salt spray, in accordance with Federal Test Method Standard No. 151, Method No. 811.1.

7.5.3.1.6 Sampling and Testing (Plating). Test specimens of the stripped cable (taken from a production inspection lot) should be plated to a minimum thickness of 0.000,050 inch and evaluated for adhesion and corrosion resistance. Production parts shall not be subject to hardness, adhesion, or corrosion-resistance tests.

7.5.3.1.7 Sampling and Testing Solution. Plating solution sample should be analyzed periodically. Renewals and recharges should be specified when necessary to maintain operating conditions. Records of analyses, additions, dumps, recharges, and lot numbers of solutions should be maintained.

7.5.3.2 Gold Plating - Nickel-Plated Conductors and Shield (Reference Section VI, Paragraph 6.3.4.2). The inspection procedure for gold plating is similar to that of nickel plating. The following procedure will note exceptions:

7.5.3.2.1 Conductor and Shield Inspection. Clean, uncontaminated conductors and shield should be checked before the gold plating is begun. The cleaning procedure for nickel-plated conductors is referenced in Section VI, Paragraph 6.3.4.2.1.

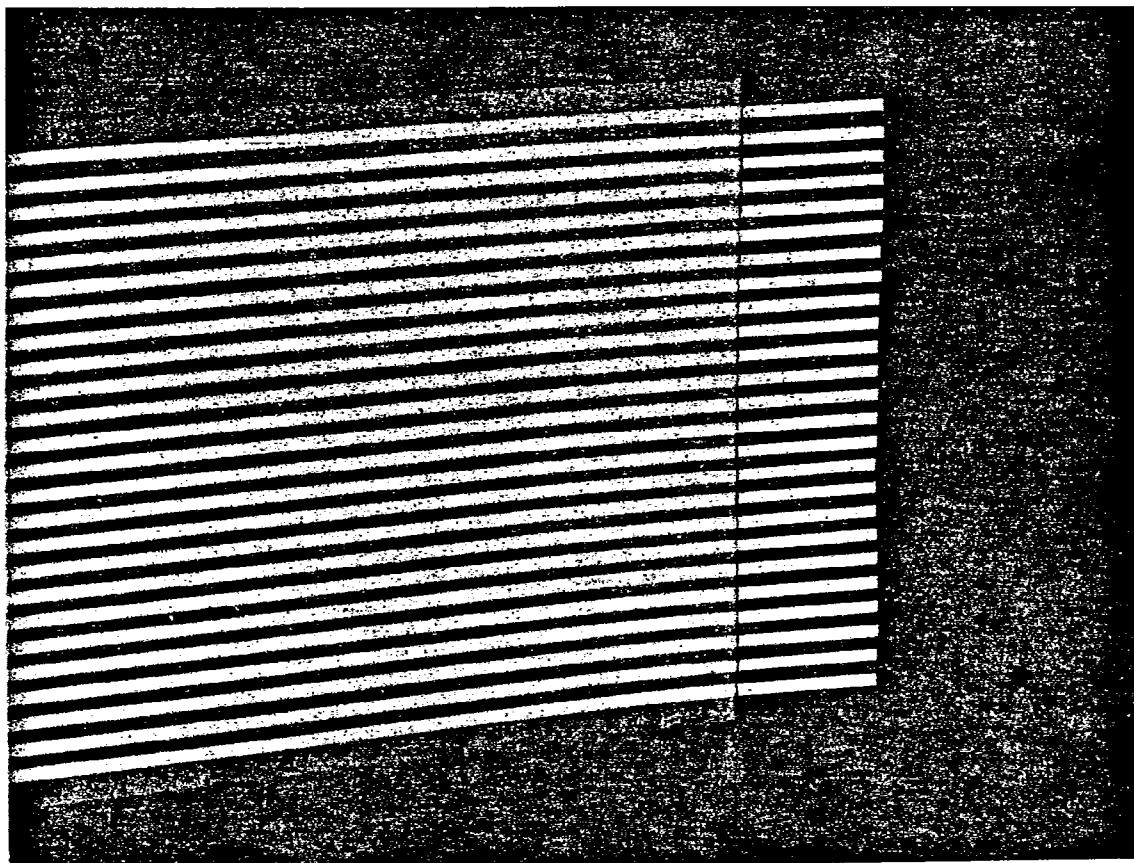


FIGURE 7-16. Properly stripped FCC.

7.5.3.2.2 Appearance. Gold plating should be smooth, adherent, and free from blisters, laminations, nodules, pits, discontinuities, and porosity. Inspection of each conductor and the shield area should be made under a magnification of 5X power.

7.5.3.2.3 Thickness. The thickness should be a minimum of 0.000,050 inch unless otherwise specified.

7.5.3.2.4 Adhesion. A plated sample cable should evidence no separation from the nickel plated conductors, after bending 180 degrees around a 1/8-inch-diameter rod. Each time the plating solution is renewed or recharged, a sample should be plated before production begins, checking for adhesion quality.

7.5.3.2.5 Sampling and Test (Plating). Same as nickel plating (Paragraphs 7.5.3.1.6 and 7.5.3.1.7).

7.6 Inspection and Test of Cable Terminations

7.6.1 Inspection of Molded-On Plug Assembly, Rectangular (Reference Section VI, Paragraph 6.3.5.1.1). The general inspection points for the assembly of molded-on plug assemblies are explained below. Four basic phases of inspection are discussed as follows:

- a. Receiving inspection (See Paragraph 7.4.4).
- b. Parts assembly.
- c. Molding.
- d. Finishing.

7.6.1.1 Receiving Inspection of Molded-On Plug Material.

7.6.1.1.1 Molding-Compound Inspection (Reference Paragraph 7.4.4).

7.6.1.2 Parts Assembly.

7.6.1.2.1 Cable Preparation for Termination. Reference Paragraph 7.5.

7.6.1.2.2 Orientation During Threading. Check for proper orientation before threading of the conductors (Reference Section VI, Paragraph 6.3.5.1.1.1 (b)).

7.6.1.2.3 Conductor Threading. The operation of threading the conductors into the plug is particularly critical. Care must be taken not to damage the conductors during the insertion process. Any bends, kinks, or scratches should be cause for rejection if they affect proper seating of the conductors in the windows.

7.6.1.2.4 Conductor Folding (Reference Section VI, Paragraph 6.3.5.1.1). Inspect the conductors, after folding, for separation of plating around the area of the fold after each operation.

7.6.1.3 Molding.

7.6.1.3.1 Environmental Requirements. The environmental requirements are as follows:

- a. The work area should have sealed floors to minimize excess dust.
- b. The work area should be shielded from excessive dust or fume-producing operations.

7.6.1.3.2 Manufacturing Verification. Verify that steps a through f referenced in Section VI, Paragraph 6.3.5.1.1.2, have been performed per instructions.

7.6.1.3.3 Molding Sample. A sample should be extracted from each manufacturing lot and evaluated for the following:

a. Dimensions per MIL-C-55544.

b. Porosity - A sample taken from each inspection lot should be sectioned and viewed for porosity under 5X magnification. The complete procedure for porosity identification is defined in Federal Test Standard No. 406, Method No. 5021.

7.6.1.4 Finishing (Reference Section VI, Paragraph 6.3.5.1.1.3).

7.6.1.4.1 Verify the following points before potting:

a. Are runners cleanly cut from the molded body?

b. Is all flash, or excess material, removed?

c. Has all the material that has flowed over the contact area been removed?

d. Is the area to be potted free from contamination and foreign matter? The plug and the cable (2 inches above plug) should be cleaned by using isopropyl alcohol.

7.6.1.4.2 Potting. The following areas should be verified during the potting process.

a. Verify that the preparation of the potting compound is per manufacturer's instructions.

b. Air bubbles entrapped during mixing should be removed by degassing before injection.

c. The plug should be inspected approximately 10 minutes after potting for cleanliness, excessive material, and surface bubbles. Surface bubbles can be broken by brushing the surface lightly with a small piece of mylar.

d. From each batch of mixed compound, fabricate a control specimen 0.25-inch thick by pouring compound into a new metal-foil cup. Each control specimen shall accompany the potted connectors throughout the potting and curing operations. Identify each specimen with manufacturer's batch number, date, and time of mixing. The control specimens should be retained until all required potting operations are completed and accepted by Quality Control.

e. The exposed surfaces of the cured potting compound should be free from cracks. No blemishes in cable area are allowable.

f. Separation of the potting compound is not acceptable.

g. The control specimen shall have a durometer hardness of Shore D25 ± 2 .

7.6.2 Inspection of Molded-On Plug Assembly (Cylindrical) (Reference Section VI, Paragraph 6.3.5.1.2). The general inspection points for the assembly of cylindrical plugs is referenced herein. Since the assembly of cylindrical plugs is similar to that of molded-on plugs, only pertinent exceptions will be noted.

7.6.2.1 Receiving Inspection of Plug Material.

7.6.2.1.1 Potting Compound (Reference Paragraph 7.4.4).

7.6.2.2 Parts Assembly.

7.6.2.2.1 Cable Stripping. Cables used should be stripped to expose the conductors to a distance of 0.425 inch.

7.6.2.3 Molding.

7.6.2.3.1 Environmental Requirements (Reference Paragraph 7.6.1.3.1).

7.6.2.3.2 Molding Sample. A sample should be extracted from each manufacturing lot and evaluated for the following:

- a. Dimensions per MIL-C-55544.
- b. Porosity (Reference Paragraph 7.6.1.3.3. (b)).

7.6.2.4 Finishing (Reference Paragraph 7.6.1.4).

7.6.3 Inspection and Test of Premolded Plug Assembly (Unshielded). (Reference Section VI, Paragraph 6.3.5.2.1). The following section includes an item-by-item procedure specifying those inspection points necessary in the assembly of a premolded plug-flat cable assembly.

7.6.3.1 Cable-Conductor Insertion. The operation of threading the conductors into the plug is particularly critical. Care must be taken not to damage the conductors during the insertion process. Any bends, kinks, or scratches should be cause for rejection if they affect proper seating of the conductors in the grooves of the plug.

The conductors should be checked carefully for the above defects before the folding operation occurs. Check to assure that the cable stripline aligns with the inside edge of the plug.

7.6.3.2 Conductor Folding. Inspection of the conductors, after folding, for separation of plating around the area of the fold should be accomplished after each operation.

Proper seating of the conductor into the conductor spacer grooves should also be verified.

7.6.3.3 Wedge Insertion. The areas as shown in Figure 7-5, View A, should be checked carefully before and after insertion of wedge.

Remove, immediately, any adhesive left on the conductors after wedge insertion, per instructions in Section VI, Paragraph 6.3.5.2.1.

7.6.3.4 Potting Base of Plug. Before potting verify plug keys are secured properly. The areas shown in Figure 7-5, View B, should be inspected while in process, and before and after potting of the plug base.

After curing, an inspection should be made of excessive potting in the areas shown. The potting compound in the base of the plug should be checked for voids, bubbles, and completeness of curve.

7.6.3.5 Installation of Silicone Rubber Seal. Inspect for the following items before and after installation of the seal (see Figure 7-5, View C).

Excessive adhesive around or on the seal should be removed after each operation. The adhesive should be cured properly.

7.6.4 Special Terminations.

7.6.4.1 Inspection of FCC Conductors to Ground-Lug Terminations (Reference Section VI, Paragraph 6.3.8).

7.6.4.1.1 Strip Cable Ends. See Paragraph 7.5.2 for cable-stripping inspection requirements.

7.6.4.1.2 Clean Conductors and Ground Lug. The FCC conductors and the area of the ground lug to be soldered should be cleaned by an appropriate method, then inspected under a magnification of 10X before tinning.

7.6.4.1.3 Tinning and Soldering Conductors and Ground Lug. The conductor ends and ground lug should be tinned immediately after cleaning. All tinning and soldering should meet the requirements of MIL-S-45743. There should be a fillet of solder visible around the end and two sides of each conductor for at least three-fourths of the stripped length. The contour of the conductors should be visible. All flux residue should be removed before epoxy application; inspect under magnification.

7.6.4.1.4 Epoxy Application. The epoxy brush coat should have a thickness of at least 0.010 inch in flat, open areas. This thickness requirements does not apply to corners or projections. The epoxy coat should be extended over 0.25 inch of the adjacent cable insulation. Inspect for complete covering of the space between the cable and the unsoldered area of the ground lug. The epoxy coat shall be even and free of bubbles and defects.

7.6.5 Inspection of FCC to Round-Wire Transitions (Reference Section VI, Paragraph 6.3.7).

7.6.5.1 Conductor Preparation.

7.6.5.1.1 FCC Stripping. The inspection parameters for flat conductor cable stripping are given in Paragraph 7.5.2.

7.6.5.1.2 Round-Wire Stripping.

- a. Quality requirements for stripping round wire are defined in MIL-S-45743.
- b. Stripped length of conductors should be 0.375 ± 0.030 inch.

7.6.5.1.3 Cleaning. Before soldering of conductors, each conductor should be cleaned ultrasonically for 5 minutes in Freon-113, then inspected under 10X magnification for cleanliness.

7.6.5.1.4 Conductor Soldering. Conductors must be soldered in accordance with MIL-S-45743; quality requirements are defined therein. Inspect all joints to make sure that joints are secure, that no parts have been damaged (thermally or mechanically), and that excessive solder does not create a possibility of short circuiting. After all wires have been soldered, inspect under magnification for flux residues. Perform a simple continuity check of each termination.

7.6.5.1.5 Potting.

- a. Reverify cleanliness of the terminations before potting.
- b. All potting compound should be applied in accordance with MSFC-PROC-196.
- c. Inspect for complete covering of the terminated area, checking for bubbles and other defects after cure.

7.7 Final Inspection and Test of Cable Assembly

Final inspection test of the assembled plug and cable should be accomplished as soon after final curing of the plug assembly as possible.

Each cable should be checked on a 100-percent level in the following major areas:

7.7.1 Visual/Mechanical.

a. Verify that all previous inspection points have satisfactorily passed the inspection points discussed in the foregoing paragraphs.

b. Check the cable assembly for cleanliness; it should be free of all extraneous potting material. Any material found should be removed by an appropriate method.

c. Verify contact-area cleanliness - each contact area should be checked for oxidation and contamination under a magnification of 10X; any contamination found should be immediately removed if possible. Excessive contact-area contamination or damage should be cause for rejection.

d. Mechanical mating operation inspection - Each cable assembly should be subjected to a mating and unmating operation. Choose the appropriate receptacle for plug mating and insert the plug several times, closing spring clamps each cycle. Inspect for the following after each cycle: (1) smooth, positive operation; (2) conductor damage, plating removal; and (3) silicone rubber gasket damage.

7.7.2 Electrical Testing.¹ The following paragraph discusses the major electrical parameters of a cable assembly that should be inspected. The following figures are for illustration purposes only. The conductor placement and pin assignments may not represent an actual production situation but indicate the basic measurements to be made. Electrical testing should be conducted as soon as possible after mechanical testing.

7.7.2.1 Unshielded Systems. The premolded plug is shown for illustration purposes only. An appropriate inspection plan can be initiated for cylindrical and molded-on plugs by utilizing the information shown.

a. Conductor Continuity - Each conductor must be inspected for continuity on each side of the mated connector pair. A dc potential of 6-volt maximum should be applied through an appropriate indicator. The voltage should be applied to the conductors as shown. Each conductor must be continuous with a maximum of 1-ohm continuity.

b. Conductor-to-Conductor Leakage - Each conductor pair (edge to edge and over/under) should be tested for leakage by performing a megger check as shown in Figure 7-6.

c. Dielectric Withstanding Voltage Test - Connector assemblies should be tested in accordance with Method No. 301 of MIL-STD-202, noting those exceptions specified in MIL-C-55544.

7.8 Installation of FCC, Inspection and Test Requirements

Since the type of clamps and the exact method of installation will vary depending upon the particular application of the FCC system, a general inspection plan is presented (Reference Section VI, Paragraph 6.4).

1. All measurements should be made with an appropriate receptacle connected to the plug.

7.8.1 Installation of Supports and Clamps. The installation of clamps and supports should consist of the following general inspection points and areas of concern:

a. Area of clamp or support attachment should be clean and free of all contamination and oxidation.

b. The clamps must be aligned properly to accommodate the number of cable bundles required.

c. The clamps and supports should be placed at appropriate intervals to prevent excessive cable slack. Supports should be placed at least every 18 inches. Slack should be provided to accommodate only the following areas:

(1) To permit ease of maintenance and one or two reterminations, except where space limitations exist. In such cases, slack may be eliminated, providing no strain is placed on cable termination.

(2) To permit free movement of shock-and-vibration mounted equipment.

(3) To prevent mechanical strain on the cable, cable supports, and cable junctions.

(4) Clamps should provide a snug grip on the cable bundles to prevent chafing and travel of the cable bundle.

7.8.2 FCC Harness - Preparation for Installation. The inspection points for preparing cable for installation are as follows.

7.8.2.1 Folding Requirements (Reference Section VI, Paragraph 6.3.6). Inspection procedure for the folding of shielded and nonshielded cable consists of the following:

a. The point at which the fold is made should be accurately defined.

b. Check for the proper bend-angle after folding.

c. Check for damage around the fold area; delamination, conductor breakage, shield damage, etc.

d. Shielded cable must be folded over a 0.25-inch-diameter spacer or rod to prevent damage.

7.8.3 Routing Cable Bundles. Grouping and routing of cables should follow the general requirements specified herein.

a. Cables must be separated from heated equipment and routed away from liquid drainage areas, or position where corrosive liquids may collect.

b. Cables and cable bundles should be separated and supported away from lines containing flammable liquids, gases and oxygen, and associated equipment. Cable and cable bundles shall not normally be attached to lines and equipment containing flammable liquid gases, unless flammable lines and equipment require electrical connections. When clearance is less than 2 inches, separation shall be maintained by attaching a cable clamp to a fitting on the equipment or a clamp on the line, and no less than 0.5-inch separation shall be maintained.

c. All cables and cable bundles should be routed to avoid abrasion, cutting, or piercing of the insulation by contact with rough surfaces or sharp edges. Cables and cable bundles may contact nonabrasive surfaces of other cables or cable bundles.

The cables should be installed and attached in such a way as to prevent damage to insulation from vibration or other movement of the cable with respect to adjacent structure and parts.

d. Strains on cable should not be absorbed by terminations but should be absorbed by clamps, supports or other approved means.

Custodians:

Army - EL
Navy - AS
Air Force - 11

Review activities:

Army - AT, AV, MI, MU, SL
Navy - EC, OS, SH
Air Force - 17, 70, 80
DSA - IS, ES
NSA
NAS

User activities:

Army - WC
Navy - MC
Air Force - 71, 84

Preparing activity:

Army - EL

Agent:

DSA - ES

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